Would scan, but which scan? A cost-utility analysis to optimize preoperative imaging for primary hyperparathyroidism
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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

CRD summary
This study assessed the best diagnostic localisation scan for patients who were about to undergo initial minimally invasive parathyroidectomy. Sestamibi single photon emission computed tomography (SPECT) plus ultrasound, with four-dimensional (4D) computed tomography (CT) if the results disagreed, was the most cost-effective strategy, followed by 4D-CT, then ultrasound, while sestamibi SPECT alone was least cost-effective. The analysis was conventional, but some of the methods were not clearly described. The authors’ conclusions appear to be robust.

Type of economic evaluation
Cost-utility analysis

Study objective
This study assessed the best diagnostic localisation scan for patients who were about to undergo initial minimally invasive parathyroidectomy, including sestamibi single photon emission computed tomography (SPECT), ultrasound, and four-dimensional (4D) computed tomography (CT).

Interventions
The analysis considered five pre-operative localisation strategies for patients with primary hyperparathyroidism: sestamibi SPECT; ultrasound; 4D-CT; sestamibi SPECT and ultrasound; and sestamibi SPECT and ultrasound, with 4D-CT if the results conflicted.

Location/setting
USA/out-patient.

Methods
Analytical approach:
The analysis was based on a decision tree, with a lifetime horizon. The authors stated that it was conducted from a societal perspective.

Effectiveness data:
A literature review was carried out by two independent reviewers, who selected studies based on their design and the reliability of their results. Meta-analysis was used to pool the evidence from multiple valid sources. The accuracy (sensitivity and specificity) of the diagnostic strategies was a key input for the model.

Monetary benefit and utility valuations:
The utility values were identified by the literature review.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and they were discounted at an annual rate of 3%.

Cost data:
The economic analysis considered the costs of surgery and the preoperative tests. These included minimally invasive or bilateral exploratory surgery, the theatre time, intra-operative parathyroid hormone monitoring, hospitalisation,
postoperative calcium supplementation, and transient or permanent hypocalcaemia. Medicare rates were used and were reported for each procedure. Some data were from the authors’ institution. Productivity losses were considered. All costs were in US $ and were discounted at an annual rate of 3%. The price year was 2010.

Analysis of uncertainty:
One-way sensitivity analyses were carried out on the clinical inputs, using ranges found in the literature or ±10% of the baseline values, and costs.

Results
The projected costs were $6,666 with ultrasound, $6,773 with 4D-CT, $7,214 with sestamibi SPECT plus ultrasound plus 4D-CT, $7,330 with sestamibi SPECT, and $7,371 with sestamibi SPECT plus ultrasound. The QALYs were 29.843 with ultrasound, 29.864 with 4D-CT, 29.885 with sestamibi SPECT plus ultrasound plus 4D-CT, 29.846 with sestamibi SPECT, and 29.859 with sestamibi SPECT plus ultrasound.

At a cost-effectiveness threshold of $50,000 per QALY, sestamibi SPECT plus ultrasound plus 4D-CT was the best strategy. It dominated sestamibi SPECT plus ultrasound and sestamibi SPECT, as it was more effective and cheaper. Its incremental cost per QALY gained over 4D-CT was $21,009, and over ultrasound was $13,066.

The incremental cost per QALY gained with sestamibi SPECT over ultrasound was $221,303. All other imaging strategies were more cost-effective than sestamibi-SPECT alone.

The accuracy of the diagnostic strategies and the cost of surgery were influential inputs, but the cost-effectiveness ranking did not change in most scenarios.

Authors’ conclusions
The authors concluded that sestamibi SPECT plus ultrasound, with 4D-CT if the results disagreed, was the most cost-effective strategy, followed by 4D-CT, then ultrasound, while sestamibi SPECT alone was least cost-effective.

CRD commentary
Interventions:
The selection of the comparators was appropriate, as the available preoperative diagnostic scans were considered.

Effectiveness/benefits:
The authors stated that the clinical inputs were identified by a literature review, but this review was not fully described; the inclusion and exclusion criteria were not given, and the designs of the selected studies were not reported. Similarly, the methods used to derive the utility values were not clear. The authors stated that the best evidence was selected, but more information would have been useful. QALYs were a valid benefit measure since hyperparathyroidism affects survival and quality of life.

Costs:
The direct medical costs and productivity losses were included to reflect the societal perspective. Standard US sources were used for the hospital costs and test costs, but few details were given for productivity losses. The unit costs and resource quantities were not presented separately, reducing the ability to replicate the analysis. The costs were treated deterministically and varied in the sensitivity analysis. Details, such as the price year and discount rate, were reported.

Analysis and results:
The expected costs and benefits were clearly presented and were synthesised, using an incremental approach, which allowed the identification of the best strategy. The analysis of uncertainty was deterministic and considered variations in the clinical and cost inputs individually; key parameters were identified. A multivariate analysis could have simulated alternative scenarios. The results of the sensitivity analyses were clearly illustrated. The authors recognised some limitations to their study, such as the fact that the model might not represent clinical patterns and that the accuracy of the tests might depend on the experience of radiologists or the quality of the equipment. The findings appear to be specific to the USA and there was no discussion of their transferability.

Concluding remarks:
The cost-effectiveness framework was conventional, but some of the methods were not clearly described. The authors’ conclusions appear to be robust.

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